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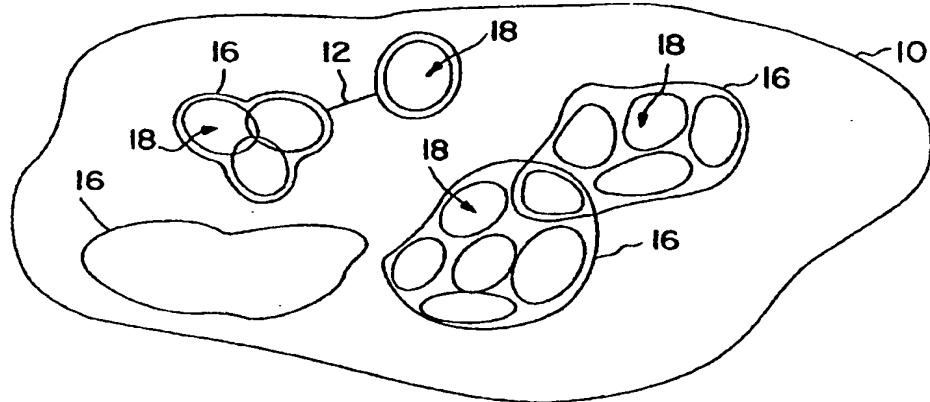
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(71) Applicant:	TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).		
(72) Inventors:	FRAGER, Hervé; 4302 St. Denis, Montreal, Quebec H2J 2K8 (CA). HODKO, Berislav; 547 Beaconsfield Boulevard, Beaconsfield, Quebec H9W 4C8 (CA). BELL, David; Apartment 176, 3794, rue Se-Andre, Montreal, Quebec H2L 3W2 (CA).		Published <i>With international search report.</i>
(74) Agents:	BOHLIN, Björn et al.; Telefonaktiebolaget LM Ericsson, Patent and Trademark Dept., S-126 25 Stockholm (SE).		

(54) Title: METHOD AND APPARATUS FOR AREA-BASED BILLING IN CELLULAR TELEPHONE SYSTEMS



(57) Abstract

A number of charging regions (18) and associated special charging rates are defined for cellular telephone subscribers. The available charging regions are selectively assembled by subscribers to define charging areas (16) within which that subscriber is entitled to special rates for cellular calls. When a subscriber is engaged in a cellular call and is located (42) within the subscriber's charging area, the subscriber is charged the special charging rate granted to the charging region within which the subscriber is located. Otherwise, the subscriber is charged at conventional cellular charging rates. In instances where the subscriber is not given the special rate, or otherwise is to be charged at more than the lowest available rate, the system notifies (50) the participating subscriber that the call is not subject to the special rate and gives the subscriber an opportunity to terminate without being charged.

-14-

Storage of this information in the traffic ticket allows the service provider to prove to participating subscribers that all completed calls were processed and billed correctly.

5 There may exist instances where the participating subscriber is physically located in a cell within its charging area, but the call is handled (perhaps due to congestion, overuse, or overcrowding) through an adjacent cell not within the charging area. The participating
10 subscriber will, accordingly, be incorrectly charged at a higher rate for the call. To correct this problem, in instances where the mobile station is ordered to perform a directed retry in an adjacent cell, the call will be charged at the lower rate applicable to the participating
15 subscriber's charging area. This is effectuated by including within the subscriber's charging area the adjacent cells surrounding the charging area, or by testing for instances of directed retry when making the location determination. Participating subscribers should
20 not, however, be informed that their charging area includes adjacent cells as this will likely result in subscriber misuse and a loss in revenue.

Reference is now made to FIGURE 4B for a description of an enhancement to the charging service of the present
25 invention used when a subscriber moves from one charging region to another charging region while a call is in progress (i.e., changes the location as determined in step 40). The charging rates (as determined in step 42) in such a situation might be different, and a comparison is
30 made in step 61 of the old charging rate and new charging rate. If the new charging rate is less than the old

-15-

charging rate (branch 63 from step 62), then call handling continues and the call is thereafter automatically charged in step 65 at the new charging rate. Processing of the call continues as described in FIGURE 4A with the 5 generation of a traffic ticket reflecting the change in step 56. If the old charging rate is less than the new charging rate (branch 67 from step 62), processing of the call continues as described in FIGURE 4A with the subscriber being given notification if desired (steps 46 10 and 50), and the grace period for event selection being given (steps 51, 52, 53, 54 and 55) to determine how the call is to be handled. If the call is accepted during the notification, or if the subscriber does not desire notification, then the call is charged at the new charging 15 rate in step 48. In instances where the participating subscriber is the calling party, it should be noted that only the options of transfer, termination or forwarding to voice mail as discussed above would be available to insure that significant additional costs would not be 20 incurred.

Reference is now again made to FIGURE 3. Information concerning subscriber charging areas 16, charging regions 18 and cells 20 is stored by the system 28 in the form of four different tables in the visitor location register 25 maintained in each mobile switching center 34. A cell table 78 stores an identification of all cells that are included within at least one of the charging areas 16. A charging region table 80 stores an identification of all charging regions 18 that are included within at least one 30 of the charging areas 16. A cell-to-charging region table 82 stores an identification of which cells 20 belong to

-16-

which charging regions 18. Finally, a charging area-to-charging region table 84 stores an identification of which charging regions 18 belong to which charging areas 16.

With additional reference again to FIGURES 4A and 4B, 5 the cell table 78, charging region table 80, cell-to-charging region table 82 and charging area-to-charging region table 84 are used in making the step 40 determination as to whether the subscriber is located in the subscriber's predefined charging area. In particular, 10 the cell table 78, charging region table 80 and cell-to-charging region table 82 are used to determine which charging regions 18 are associated with the cell 20 handling the call. The charging area-to-charging region table 84 is then used to determine whether any of the 15 identified charging regions 18 belong to the participating subscriber's charging area 16.

In the event the participating subscriber roams to a foreign cellular area 10, the mobile switching center 34 will request delivery of the subscriber's charging area 20 information from the home location register 74. This information is then stored in the visitor location register 76 of the currently serving mobile switching center 34, and will be used by the mobile switching center 25 to determine and notify the subscriber of applicable calling rates. Provision is also made for the mobile switching center 34 to convert received participating subscriber charging area information from the home area 10 of the subscriber to determine a comparable charging area 16 to be implemented for the participating subscriber 30 in the current area 10. Thus, the charging areas feature is supported as the subscriber roams from area to area.

-18-

the invention is not limited to the embodiment disclosed,
but is capable of numerous rearrangements, modifications
and substitutions without departing from the spirit of the
invention as set forth and defined by the following
5 claims.

-19-

WHAT IS CLAIMED IS:

1. A cellular communications system, comprising:
 - a plurality of cells;
 - at least one charging region having a special charging rate for subscriber cellular calls and wherein each charging region comprises at least one of the plurality of cells; and
 - means responsive to a cellular telephone call with a subscriber located within a certain one of the cells for charging the special rate for said call when the certain cell is located within the at least one charging region, and for charging a different charging rate for said call when the certain cell is located outside of the at least one charging region.
- 15 2. The cellular communications system as in claim 1 further including means for determining the location of the subscriber within the certain cell and in relation to the at least one charging region.
- 20 3. The cellular communications system as in claim 1 further including means for notifying the subscriber of the charging rate for said call.
- 25 4. The cellular communications system as in claim 3 wherein the means for notifying comprises means for sending an audible message indicative of the charging rate for the call, the audible message to be broadcast to the subscriber via a mobile station carried by said subscriber.
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-20-

5. The cellular communications system as in claim
3 wherein the means for notifying comprises means for
sending a data message indicative of the charging rate for
the call, the data message to be displayed to the
5 subscriber via a mobile station carried by said
subscriber.

10 6. The cellular communications system as in claim
1 wherein the cell or cells included within the at least
one charging region are selected by a provider of the
cellular communications system.

15 7. The cellular communications system as in claim
1 further including a charging area selected by the
subscriber to include at least one of the charging
regions, the means for charging further operating to
charge for said call the special rate of the charging
region provided the certain cell is within the charging
area selected by the subscriber, and for charging the
20 different rate for said call when the certain cell is
located outside of the charging area selected by the
subscriber.

25 8. A cellular communications system, comprising:
a plurality of cells;
a plurality of charging regions each having a special
charging rate for subscriber cellular calls and wherein
each charging region comprises at least one of the
plurality of cells;
30 a charging area selected by a cellular subscriber to
include at least one of the one charging regions; and

-21-

means responsive to a cellular telephone call with a subscriber located in a certain one of the cells for charging the special rate of that certain cell's charging region for said call when the certain cell is located 5 within the charging area selected by the subscriber, and for charging a different rate for said call when the certain cell is located outside of the charging area for the subscriber.

10 9. The cellular communications system as in claim 8 further including means for determining location of the subscriber within the certain cell and in relation to the charging region.

15 10. The cellular communications system as in claim 8 wherein the cell or cells included within the charging region are selected by a provider of the cellular communications system.

20 11. The cellular communications system as in claim 8 further including means for notifying the subscriber of the rate for said call.

25 12. The cellular communications system as in claim 11 wherein the means for notifying comprises means for sending an audible message indicative of the rate for the call, the audible message to be broadcast to the subscriber via a mobile station carried by said subscriber.

-22-

13. The cellular communications system as in claim
11 wherein the means for notifying comprises means for
sending a data message indicative of the rate for the
call, the data message to be displayed to the subscriber
5 via a mobile station carried by said subscriber.

14. The cellular communications system as in claim
11 wherein the means for notifying provides notice of the
rate for calls during call set-up before completion of
10 call connection or during hand-off.

15. The cellular communications system as in claim
11 wherein the means for charging further includes means
for recording for each call the cell location of the
15 subscriber as well as whether notification of the special
rate was given.

16. A cellular communications charging method,
comprising the steps of:
20 defining a charging region;
determining whether a subscriber involved in a call
is located within the defined charging region; and
charging the subscriber a special rate for the call
if said subscriber is located within the defined charging
25 region, and a different rate for the call if said
subscriber is located outside the defined charging region.

17. The method as in claim 16, further including the
step of notifying the subscriber of the rate based on
30 subscriber location in relation to the defined charging
region.

-23-

18. The method as in claim 16 wherein the step of defining the charging region includes the step of selecting by a cellular service provider of each charging region.

19. The method as in claim 16 further including the step of defining a charging area for each subscriber, the charging area comprising at least one charging region, the step of charging further comprising the step of charging the subscriber the special rate of the charging region where the subscriber is located if that charging region is included in the subscriber's charging area.

15 20. The method as in claim 19 wherein the step of defining the charging area includes the step of selecting by the subscriber of the charging region or regions to be included in the subscriber's charging area.

20 21. A cellular communications charging method, comprising the steps of:

defining by a cellular service provider of a plurality of charging regions across a cellular service area;

25 selecting by a subscriber of at least one of the defined charging regions to be included in a charging area for that subscriber;

-24-

for each call, determining whether the subscriber is located within the defined charging area; and

charging the participating subscriber a special charging region rate for the call if the subscriber is located within its selected charging area, the special rate being the rate for the determined charging region within which the subscriber is located, and charging a different rate for the call if the subscriber is located outside its selected charging area.

10 22. The method as in claim 21, further including the step of notifying the subscriber of the rate to be charged for the call.

15 23. The method as in claim 22 further including the step of waiting for the expiration of a grace period following notification to give the subscriber an opportunity to handle the call in a manner other than to engage in a communication.

20 24. A cellular communications system, comprising:
a plurality of mobile stations, each mobile station assigned to a subscriber having selected a charging area comprising certain cells within a plurality of cells;
25 a base station for each one of the plurality of cells, each base station in communication with proximately located mobile stations; and

-25-

a mobile switching center connected to each base station and including:

means for storing a record of the each subscriber's selected charging area;

5 means for determining for each call whether a certain subscriber is located within a cell of its selected charging area; and

10 means responsive to the means for determining for charging the certain subscriber a special rate for calls when located within the selected charging area for that certain subscriber and a different rate for calls when located outside the selected charging area for that certain subscriber.

25. The cellular communications system as in claim 24
15 wherein the mobile switching center further includes means for notifying the certain subscriber of the rate to be applied to the call.

26. The cellular communications system as in claim 24
20 wherein the mobile switching center further includes means for processing a received foreign charging area to convert the received charging area to provide a charging area for visiting subscriber use.

25 27. The cellular communications system as in claim 24
wherein the subscriber selected charging area comprises subscriber selected ones of a plurality of cellular

-26-

service provider selected charging regions, each charging region having its own special rate, the means for charging applying the special rate of the charging region within which the subscriber is located provided that charging
5 region is located within the subscriber's selected charging area.

FIG. 1A

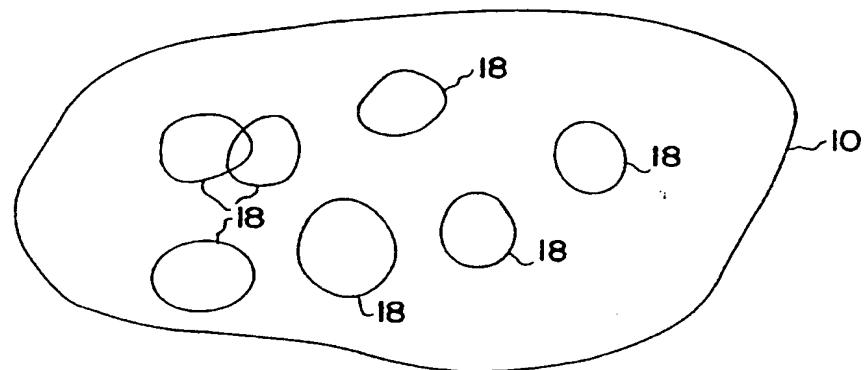


FIG. 1B

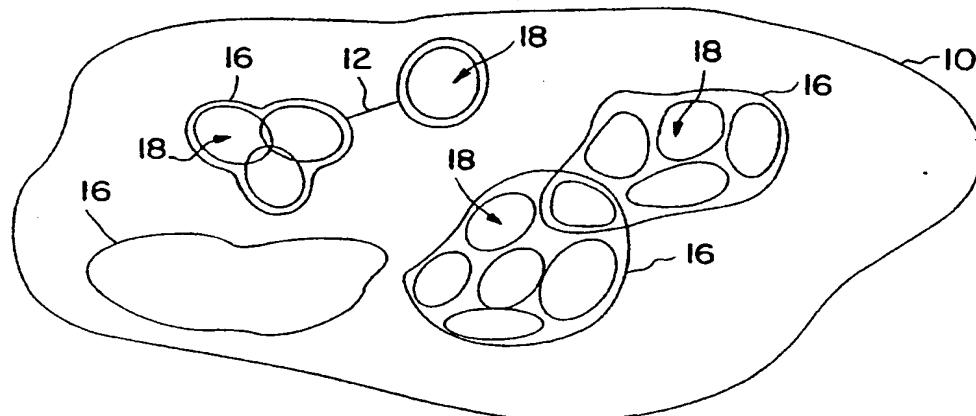
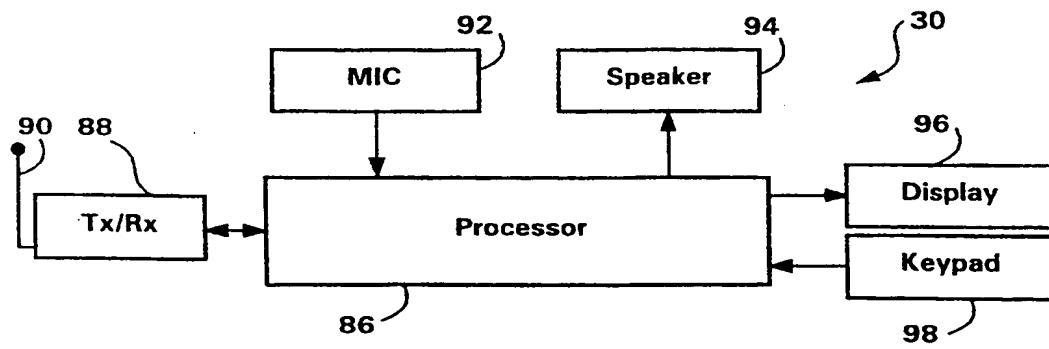


FIG. 5



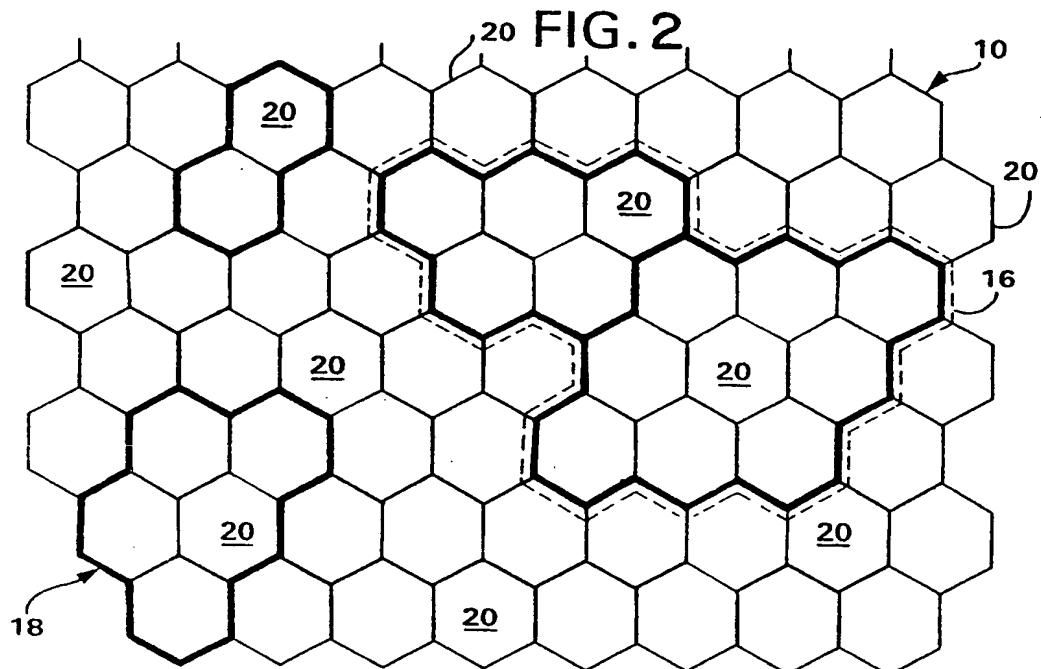
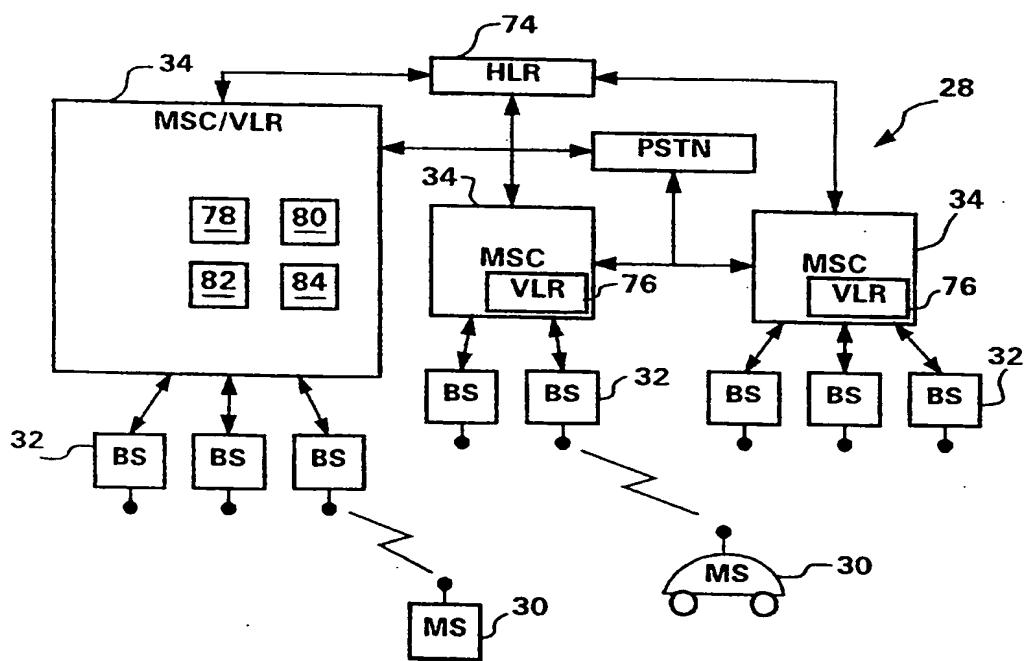
**FIG. 3**

FIG. 4A

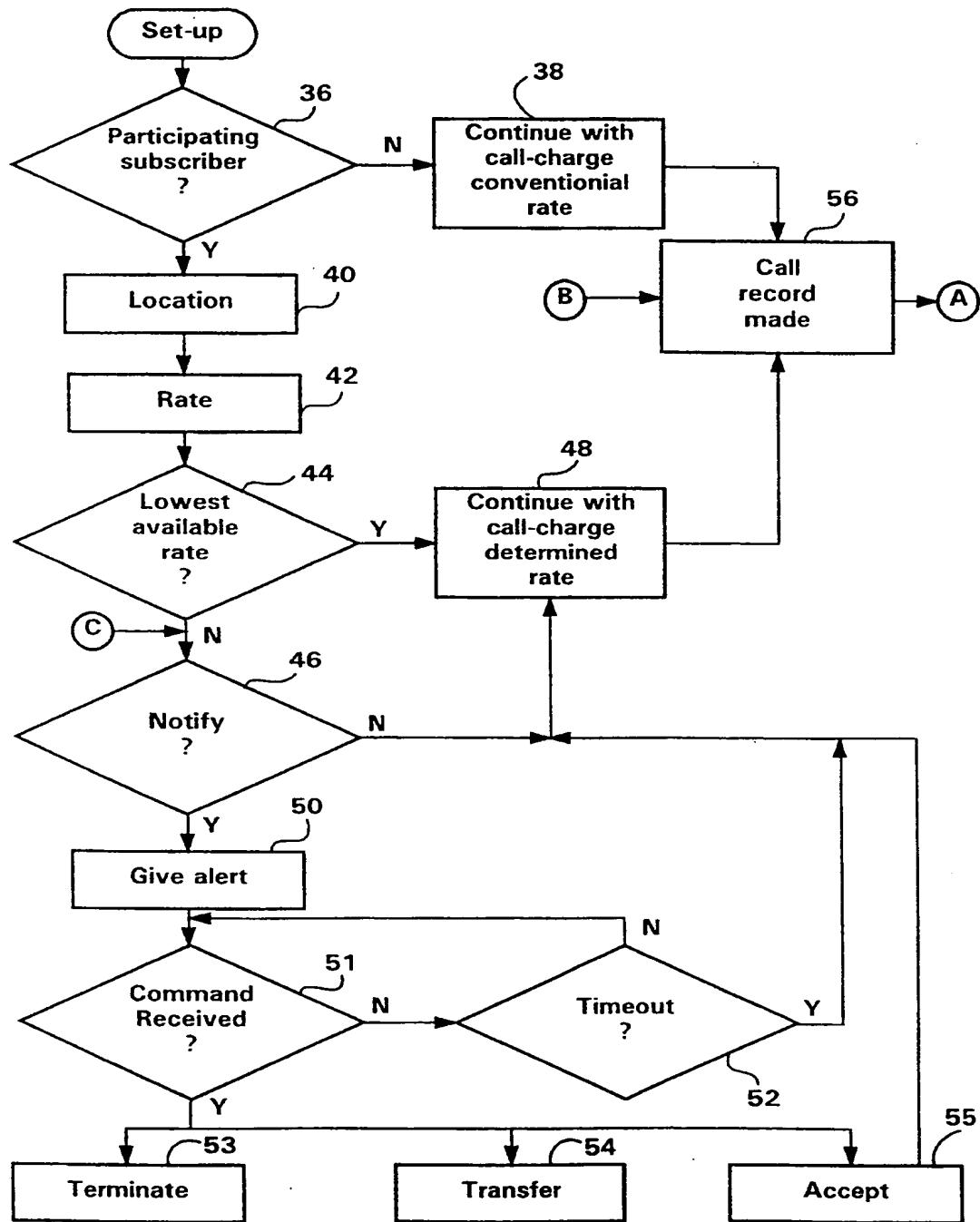


FIG. 4B

